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The Process Semantics of Time and Space as Anticipation

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Abstract

Time and space in western culture whether intellectual or popular are treated as independent and absolute. A common example is the notion of travel through time which treats time and space at the start and finish of the journey. That space and time appear only relative in the manner of their measurement was asserted by Newton in his first Scholium (at the beginning of his Principia) even though the consequences of his work suggest otherwise as it led to relativity and quantum mechanics.

Absolute implies permanence: relative implies variety. The distinction is often in a context where time is implicit as in the comparison of the stationary and the non-stationary but the distinction may be spatial just as well as temporal. Now the stationary and non-stationary respectively of Parmenides and Heraclites are brought together by rising to the metaphysics of the philosophy of process. Process has the two levels of a fixed intension and a diversity of extensions. This intension-extension divide was possibly not made explicit until the 17th century work of the Port Royal school of logic. Yet it is only with the emergence of category theory in the second half of the 20th century that it is possible to express the distinction in a single mathematical form. Category theory itself started with the category of sets from the static view but with the development of the monad is now able to give the Process view of the permanent, combining both the stationary and the non-stationary. The intension of any entity is the entity itself; the extension of the entity are versions of itself and if proper only partial.

There is an adjointness $\Sigma \dashv \Delta \dashv \Pi$ between the intension and any extension:
Σ: intension → extension; Δ: extension → intension; Π: intension → extension.
Σ identifies the existence and Δ the nature of the intension/extension relationship from the permanent world view while Δ identifies the existence and Π the content of the extension/intension relationship from the continuously varying logical world view. Σ is the free functor representing contingent existence, Δ the underlying functor identifying the syntax and Π the universal functor providing the whole semantics.

Time & Space are in the intension; Time || Space are in the extension where & and || are full abstractions of the connectives AND and OR. Intension is the permanent Process, a preorder, not distinguishing time from space nor space from time. Formally this is the monad induced by the adjunction $\Sigma \dashv \Delta \dashv \Pi$. The extensions are the possible instantiations of process, preorders in time and space, formally co-monads induced by the co-adjunction $\Pi \dashv \Delta \dashv \Sigma$. The intension provides the unification of relativity and quantum theory. Their separate classical representations respectively in Minkowski and Hilbert spaces are extensional models. However, the property of a topos is that a contravariant extension is itself monadic. An anticipatory system is a microcosm of the world and a

monadic intension. Anticipation is therefore more fundamental than either time or space. Anticipation is the natural preordering on any system.